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# PARCIMONY IN NUTRITION

SIR JAMES CRICHTON-BROWNE

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# PARCIMONY IN NUTRITION

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BY

SIR JAMES CRICHTON-BROWNE

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LORD CHANCELLOR'S VISITOR IN LUNACY, LONDON

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# PARCIMONY IN NUTRITION

[From the Presidential Address to the Section of Preventive Medicine at the meeting of the Royal Institute of Public Health at Buxton, England, in July, 1908. Revised and expanded by the Author.]

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# CHAPTER I

## THE UP-KEEP OF THE BODY

THE health and welfare of individuals and of peoples must depend on right methods of living, and of all methods of living the most momentous are those relating to the up-keep of the body by alimentation. It is food that supplies the material for that perpetual series of transformations in which life consists, and it must be adequate in quantity and suitable in quality if these transformations, of so many different kinds, in so many different organs, are to proceed with that nicely balanced adjustment that is known as health. Fuel for heat and energy, stuff for repair, in proportion to work done and waste incurred, must be requisitioned if a man is to live and prosper, and any excess or deficiency in these is followed by impairment of

Alimentation.

Health Requirements

strength and vigour, by tissue-degeneration and by diminished resistance to the inroads of disease. Nutrition is therefore an important branch of preventive medicine. Could we but secure adequate supplies and an equitable redistribution of food, restricting gluttony on the one hand and abolishing starvation on the other, we should vastly lighten the task of the sanitary and of the social reformer, and witness a gratifying drop in the death-rate.

Nutrition.

Proper Food.

It is the recognition of the vital significance of a proper food supply that leads to the question so often heard in these days, "What must I eat to be saved?" a question to which answer is made by a shouting multitude of enthusiasts, cranks and empirics, each with an infallible dietetic system of his own. Now, I do not propose to touch on any of these mutually destructive systems, with their extraordinary hygienic and economic advantages, but I wish to direct attention to a general dietetic tendency, which is unmistakable at this time, a tendency which I designate parcimony in nutrition. We have retrimmed our sails and are on

a new tack. In the last century it was redundancy in nutrition that was in vogue, and it was feeding up that was on all hands recommended, but now it is frugality in nutrition that is in the ascendant and a spare diet that is insisted on. And this is no mere fashionable crotchet or popular craze. Physiologists and medical men of high authority are preaching not merely simplicity of diet but a degree of abstemiousness that would hitherto have been regarded as dangerous. Some of them tell us roundly that intemperance in eating has become universal in civilized races, and that we are all habitually consuming just double the amount of food we require; and others who do not go to this extreme are still inclined to believe that as regards certain kinds of food we have accustomed ourselves to more than is good for us, and might beneficially restrict our indulgence in them. The trend is unquestionably towards reduced dietary.

The Spare Diet.

Now, I cannot, in a brief space, hope fully to criticize, were I competent to do so, the arguments by which this new departure in dietetics is supported by the

The New Dietetics.

able men who are its exponents. To some small extent I sympathize with it, but as a bystander watching the current which gathers strength as it flows on, I venture to point out to those who are ready to embark on it, that it may involve certain perils and that it may be well to pause before committing ourselves to it. The campaign against over-feeding is all very well, but we need not substitute under-feeding for it, or rashly accept the new and startling standards that are prescribed for us. That there is a vast amount of over-feeding in most civilized countries is unquestionable. With us extreme obesity is not, perhaps, as common as it was fifty years ago, before the Banting era. There is a general recognition of its inconveniences and risks. Precautions are taken against it and cures of many kinds and of varying efficacy are resorted to. The weight-book in any West End Club shows by its frequent and punctual entries and marginal and explanatory notes how jealously middle-aged men regard even a trifling tendency to corpulency, and the advertisements of anti-fat remedies of one kind and another

Obesity.

indicate how anxiously women watch their waist-bands. Still, however, there is far too much adipose tissue about in certain social strata, betokening too much energy in the form of food and too little energy in the form of work, and the need of a reduction in the consumption of carbohydrates or fats. The luxurious indulgence of the rich in these days is shown, not so much in the quantity of food of which they partake, as in its quality and in the cost of its production and preparation. The *chef* is puzzled to devise dishes that are sufficiently expensive to meet the requirements of his patrons, and dinners are served on a scale of extravagance against which unsophisticated human nature revolts. The dietetic principles underlying those dinners are sound, their component parts are carefully selected and the sequence of these is strictly scientific, and so long as they are only occasionally indulged in no medical objection can be taken to them, in whatever light they may present themselves to the eye of the economist. "The sight of means to do ill deeds makes deeds ill done," and the long series of dainties

Costly Dishes.

paraded at such dinners does tempt to eating beyond the immediate needs of the body. But an occasional and moderate excess of food is believed to be not only harmless but beneficial. Tennyson's Northern Farmer ascribes virtue to

> "Them as has coats to their backs and takes their regular meals;"

but occasional irregularity in meals has its advantages, and the large Sunday dinner of the working man contributes perhaps to the wants of the whole week. It is well to have a reserve in the body, stores to draw upon in emergencies.

Acute over-feeding.

Acute over-feeding, as it is called, does not require consideration. People rarely die of surfeit in these days, and death attributed to that cause is generally due to interference by a distended stomach with the action of an enfeebled heart; but chronic over-feeding, or the habitual ingestion of an excessive amount of nutriment, is one of the burning questions of the hour, and has assumed an entirely new aspect in recent years. Over-feeding no longer means over-feeding in the old sense, of something in excess of the accepted physiological standard, for an

entirely new and much-lowered physiological standard has been presented to us, according to which it would seem, as I have said, that the whole population of all civilized countries, with the exception of a few individuals who have found salvation, is addicted to over-feeding, and is thereby incurring divers pains and penalties.

Alleged prevalence of Excess.

Statistical and experimental studies carried out by many physiologists on large groups of individuals have led to the general acceptance of certain dietary standards, such as those of Voit, of Munich, and Atwater, of the United States. With allowances for the influence of body-weight and build, of sex and age, of climate and season, of occupation and personal idiosyncrasy, these standards have been found to accord pretty closely with the diets to which custom and experience have guided mankind. The Voit standard allows for the average man under average conditions, doing moderate work, 118 grammes of proteid food, 56 grammes of fat, and 500 grammes of carbohydrates—such as sugar and starch, with a total fuel value of 3055 large

The Voit Standard.

calories or heat units per day, and it increases the daily allowance under hard work to 145 grammes of proteid, 160 grammes of fat, and 450 grammes of carbohydrate, with a total fuel value of 3370 calories. Professor Atwater's standard for a man doing moderate work places the proteid requirement at 125 grammes with sufficient fat and carbohydrate to equal 3500 calories; and it is certainly noteworthy that a large number of independent observers in different countries have in their calculations approximated to the Voit and Atwater standards, being, however, almost without exception, somewhat above these in their proteid allowance.

Professor Atwater.

Food Minimum.

Now, these Voit and Atwater standards have hitherto been regarded as representing the minimum of what is necessary for the maintenance of health and strength, for their authors have had in view man's aptitude for self-indulgence, and have therefore fixed their standards at the lowest reasonable level. These standards are to be taken not as boundaries which it is hazardous to transgress occasionally or even habitually in

an upward direction, but as limits below which there should be no descent, if health and strength are to be maintained. But the belief in these standards has been rudely shaken by a new dietetic philosophy that comes to us from America, teaching that these standards are false, that the quantities of food-stuffs allowed by them are far larger than the actual demands of the body require, and that conformity to them means the loading of the system with unnecessary material which hampers the smooth running of its delicate machinery upon which so much depends. The dietary habits of mankind and the dietary standards based thereon, are not, it is affirmed, in accord with the true physiological requirements of the body. As regards proteids—the most important element in any diet, for they alone of foods are both tissue-formers and work and heat producers—we are told that, to our no small injury, we have been partaking of double or perhaps treble the amount that is necessary.

An American Doctrine.

Proteids.

The root of this new and startling philosophy is to be found in Mr. Horace Fletcher, an American gentleman who

Mastication.

has discovered, or believes he has discovered, the true inwardness of mastication. Middle-aged, obese, dyspeptic, in failing health, rejected by an insurance company, and unaided by many medical men consulted, he accidentally discovered that by slow and deliberate eating his condition improved. He literally chewed himself back into health, and in doing so satisfied himself that the whole process of bodily nutrition is profoundly affected by the preliminary treatment of the food in the mouth. He convinced himself that by the thorough mastication and insalivation of food appetite is satisfied with a much smaller amount than is ordinarily sufficient for that purpose, and that at the same time bodily and mental well-being is marvellously enhanced.

Ethics of Eating.

Mr. Fletcher sums up his philosophy in these words: "If you eat only when you have an earned appetite, masticate your food thoroughly, and take great care to eat only what your appetite approves, the rest will take care of itself." No very novel doctrine, after all.

It might be thought that Mr. Horace Fletcher's discovery of the utility of

mastication was merely a revival of a precept inculcated in every nursery but too much forgotten in these hurried times. He was really anticipated in it by Mr. Gladstone, who a number of years ago gave a powerful impulse to mastication in England by attributing his own success in life largely to the fact that he had always made it a rule to give every tooth a chance, and had therefore made thirty-two bites at every morsel, forgetting perhaps as he said so that the teeth work in pairs, and that sixteen bites would have effected his purpose. But in Mr. Horace Fletcher's hands mastication has branched out in many directions and become an art and a new theory and discipline of life. He is an enthusiast, a man of great ability, of broad culture, of philanthropic aims, and he has drawn round him a group of enthusiasts, and it must be confessed that his system could scarcely for a day survive their panegyrics if it entirely depended on them for support. They do protest too much. We are told that all former views on dietetics have been unsound, incomplete, and unscientific, and that

Mr. Gladstone's System.

New Developments.

"Fletcherism," as it is called, opens up to us a new heaven and a new earth.

Fletcherism Commended.

Mr. Hubert Higgins, a Cambridge lecturer, speaks of Mr. Fletcher's "great physiological discovery," while Dr. Edward Hooker Dewey, of Meadville, Penn., assures Mr. Fletcher that "in the line of dietary reform you have done better work than the entire medical profession has done from the dawn of history. . . . What you have done to unfold physiological mastication means more for human weal than all the mere medical prescribers have given the world from Adam to the present time."

Dr. J. H. Kellogg, of the Battle Creek Sanatorium, Michigan, writes, "You are certainly promoting the most important hygienic reform which has been brought forward in modern times; you deserve the gratitude of the whole world." "We are chewing," he writes again, "hard at Battle Creek, chewing more every day We are continually thinking and talking of you and the wonderful reform you set going. We have gotten up a little Chewing Song which we sing to the patients. The idea of munching parties

is a good one." . . . "A quartette sang the Chewing Song just before my lecture in the parlour last evening." . . . "I read some of your notes to my colleagues, and they were so much affected that tears came into their eyes."

Assimilation of Proteids.

But as regards the proteid constituents of food, all this magnification of chewing is beside the mark. They are attacked by digestive ferments at two points in the alimentary canal, in the stomach by pepsin and in the small intestines by typsin. As regards their digestion, their passage through the mouth and insalivation is of little importance. A very brief sojourn in the mouth is necessary for the origination by them of those nervous impulses which, as Pavlov has taught us, are influential over subsequent digestive processes. Hence, all high proteid-feeding animals bolt their food, and are, as Mr. Higgins learnedly described them, "psomophagic," as opposed to the low proteid-feeders, which are masticatory and ruminating, or "poltophagic." The essence of the salivary digestion is the transformation of starch into sugar, and that takes place partly in the mouth during

Pavlov's Teaching.

Salivary Action.

mastication, and partly in the stomach, where it proceeds until diastatic action is put a stop to by the rising acidity of the gastric contents. The time of salivary digestion is therefore brief, and to be of avail it must be energetic. The digestion of starch by the saliva is never more than partial, and, seeing that the pancreatic secretion lies in reserve in the duodenum, and that that has an intense amylolytic activity, it is obvious that starchy matters need not fail of being digested, even when not subjected to salivary action. It is the pancreas that compensates for the want of the salivary secretion in those persons who have lost their salivary glands owing to their tubercular invasion, and in those who are fed for years through an œsophageal tube, and continue in good health.

Perfervid Disciples.

Mr. Fletcher accepts all the preposterous adulations lavished on him by his perfervid disciples with complacency, and tells us that he has received within two years more than a thousand letters, bearing the approval of the writers, who report benefits received which seem "really miraculous." Over-eating and wrong-eating are, he maintains, the prime

cause of intemperance in drinking,—and he evidently anticipates that the next generation may chew themselves out of insanity and crime, if, one must add, they only retain the teeth with which to do it. Chewing Possibilities.

All this savours somewhat of the patent medicine advertisement of the most unblushing kind, but fortunately for Mr. Fletcher's scientific reputation, his experiment attracted the attention of some sober-minded physiologists. Dr. Ernest Van Someren, of Venice, having met Mr. Fletcher and been impressed by his statement of his system of economic nutrition, tried it on his own person with marked success in the treatment of gout from which he had long suffered, and being anxious to extend to others the benefits which he had himself secured, read a paper on the subject to the British Medical Association Meeting in 1901, and afterwards to the Congress of Physiologists at Turin. That paper interested the late Sir Michael Foster, and led to Mr. Fletcher being invited to Cambridge, where some observations were made which were so far confirmatory of his Van Someren's Impressions.

claims. In two individuals it was found that complete bodily efficiency was maintained for some weeks upon a dietary which had a total energy value of less than one-half of that usually taken, and comprised little more than one-third of the proteid consumed by an average man. With proper caution Sir Michael pointed out that it was doubtful whether continued efficiency could be maintained on such low values as these, but he recognized that the Cambridge experiments, although merely preliminary, made it highly desirable that further tests of Mr. Fletcher's system should be instituted in a laboratory thoroughly equipped for such an investigation. That investigation has since been undertaken in the Scientific School of the University of Yale, by Professor Chittenden, and with results that have attracted widespread attention. But as the investigation has gone on, the centre of interest in respect of it has shifted. The chewing business has become unimportant, except in so far as it diminishes the craving for food, and the momentous question is now, What is the proper daily proteid intake to meet the needs of the human body?

Sir Michael Foster.

Professor Chittenden's Investigations.

# CHAPTER II

## PROTEID FOODS

THE question of the appropriate proteid intake Professor Chittenden has dealt with in a manner that is at once painstaking and brilliant, laborious and fascinating. His works on "Physiological Economy in Nutrition" and on "The Nutrition of Man" are much more than a record of personal experience and opinion. They describe an elaborate and extended experimental study in which he has been furthered by grants and facilities given by public bodies and assisted by colleagues of high scientific attainments, and which has been carried on in conditions more favourable than have ever before attended any inquiry into the problems of nutrition. Every observation has been made by an expert and verified by competent witnesses, and the conclusion arrived at is stamped with high authority.

Experimental Study.

And, briefly stated, that conclusion is that the daily amount of proteid or albuminous food required for the maintenance of health and vigour is not more than one-half that hitherto regarded as necessary. Observations upon groups of professional men, army volunteers, university athletes and animals have satisfied Chittenden that for a man weighing 70 kilograms or 154 lbs., there would be required daily 59·5 grammes — say 60 grammes—of proteid food to meet all the requirements of the body. "These are," he said, "perfectly trustworthy figures with a reasonable margin of safety, and carrying perfect assurance of really being more than sufficient to meet the true wants of the body, adequate to supply all physiological demands for reserve proteid and able to cope with the erratic requirements of personal idiosyncrasies."

Reduced Requirements.

True Bodily Wants.

It is impossible here systematically to review Chittenden's work, or even to follow up his experiments, showing where, notwithstanding the punctilious precautions taken, possibilities of fallacy exist, or to point out in what directions further investigation is necessary. It must be

admitted that he has made out a strong case and has shaken to its base the fabric of established opinion on food questions on its physiological side, but he has not yet overthrown it, and my object is to submit to you some considerations which should give us pause before accepting Chittenden's views, and proceeding to revise from the foundation our whole system of practical dietetics and to cut down by one-half our ordinary meat ration. A Strong Case.

Apart from personal predilections, there are grounds which would almost induce one to hope that Chittenden's views may prevail. They appeal to the purse. Proteid is the most expensive of foods; and if all our wants can be met by an amount of it one-half that ordinarily consumed, then a satisfactory curtailment of expenditure may be effected. They appeal also to our hopes for the future of humanity. In his Presidential Address to the British Association at its Bristol meeting in 1898, Sir William Crookes pointed out that the world stands in jeopardy of nitrogen starvation owing to the inadequacy of all its possible wheat- An Appeal to the Purse. Sir William Crookes.

bearing areas to supply to the increasing population the amount necessary of that most important of food cereals, of which we consume in this country six bushels per head of population per annum. Sir William thought that if the present rate of increase of population be maintained, and if arable areas of sufficient extent cannot be adapted and made contributory to the subsistence of so great a host, the terrible dearth must come upon us in 1931. But Chittenden hastens to our relief, for if we can reduce our proteid consumption by one-half, we shall postpone the catastrophe for a few years, at any rate even without the aid of the chemist, who may, Sir William Crookes believes, effect our rescue by catching and fixing atmospheric nitrogen.

The Terrible Dearth.

But, however alluring in some aspects Chittenden's conclusion may be, it conflicts violently with the orthodox physiological faith. It must be noted that his standard of proteid food is not only one-half lower than that of Voit, but is still further below the common practice of the enormous majority of mankind in Europe and America, and that is an argument

against it which he has not answered. Unanswered Argument.
He points to the triumphs of modern scientific methods in revolutionizing our notions as to the causation of diphtheria and typhoid fever, and suggests that the same methods may equally revolutionize our notions of our dietetic requirements. But there is no analogy between the cases. In the one, science is dealing with an accidental and external cause of disease, in the other with an universal and constitutional habit. It is an initial objection to Chittenden's view which is not easily met, that it contravenes all human experience. Human Experience.
If he is right, then all the world up to this time, with the exception, perhaps, of a few supposed faddists, has been wrong. Gluttony has somehow become universal. It is *Chittenden contra mundum.* The nutrition of man involves an intelligent appreciation of the needs of the body, under different conditions of existence, and constant modification and adaptation to changing environment, and states of age, activity, and health. There No Finality.
is no finality about it. Science has certainly not spoken her last word respecting it, but deep down beneath all superficial

fluctuations and gradual evolutions there are certain fundamental, instinctive nutritional demands that cannot be interfered with without risk. These are embodied in old-time tradition and customs, and one of these is the demand for a proteid intake much more than double, indeed nearly treble, what Chittenden would allow.

Bases of Dietetics.

It is not on *à priori* physiological data, nor yet on laboratory experiments—elucidative and educational though these may be—that the science of dietetics is based, but on common observation and on the hereditary customs and habits of mankind. The lower animals select with unerring precision, as long as they are in a natural environment, from the materials around them those best fitted to their wants, and they do this by instinctive discernment inherited from a long line of naturally selected ancestors, while they are checked in their consumption by a sense of repletion of coeval origin. We unhesitatingly infer that the articles they choose are, of all nutrient material accessible to them, those best adapted to the special needs of their economy, and that their consumption of them is proportioned to their needs for

the time being. But man is, as regards his bodily functions, subject to the same laws as those which govern the lower animals, and we cannot doubt that in the formation of his dietetic habits he has been guided by the same kind of influences which have been operative throughout the animal creation in the choice and consumption of food. Common Laws.

These habits are tardily ingrained instincts, a little lower than voluntary determinations, and only a little higher than the reflexes upon which life depends. They have been differentiated and elaborated as he has advanced in civilization, but not superseded, for civilization is not the antithesis of Nature, but a higher branch of natural history. Natural instinct or primitive experience has guided the different varieties of our species in their selection of viands suitable to their geographical situation and modes of life, has restrained them within proper bounds in their consumption of these, and has even taught them to combine and balance the different constituents of these in a way on which chemical science can scarcely improve. The Selection of Viands.

Sir William Roberts.

"The generalized food customs of mankind," said the late Sir William Roberts, "are not to be viewed as random practices adopted to please the palate or gratify an idle or a vicious appetite. These customs must be regarded as the outcome of profound instincts which correspond to certain wants of the human economy. They are the fruit of a colossal experience accumulated by countless millions of men through successive generations. They have the same weight and significance as other kindred facts of natural history, and are fitted to yield to observation and study lessons of the highest scientific and practical value." Realizing the hidden wisdom of the cœnesthesis,

Darwin and Sensations.

Darwin said, "In matters of health, always consult your sensations."

It is obvious that in the study of dietetic customs those most widely disseminated and followed by many races and vast populations are of higher validity than those confined to small communities, and further, that the practices of the more successful races and the more affluent classes of a nation are more likely to yield good dietetic models than the

practices of the backward races and poorer classes. The former have had greater freedom of choice, and their success in the struggle for existence is evidence of the suitability of their food habits. Now the British race and the other races of Western Europe, together with their descendants in different parts of the globe, are on the grounds stated best able to supply us with a body of dietetic customs that may serve as a model, and the salient characteristic of their diet has always and everywhere been its large proteid content. It has invariably consisted of cereal and farinaceous articles, fruit and animal flesh, and the success of the races, their vitality and energy, might almost be measured by the degree in which animal flesh has entered into their diet. All the successful races have habitually consumed proteid far in excess of the Chittenden standard and far in excess of what was required for tissue repair, and when we find a definite relation between proteid consumption and racial success there is good ground for believing that behind it there is biological law.

European Customs.

Proteid Consumption.

Biological Law.

I know not exactly how things stand

now, but some years ago it was calculated that the consumption of meat per head per annum was in England 136 lbs., in France 40 lbs., in Russia 35 lbs., and in Belgium 84 lbs. It was larger in cities than in rural districts, and largest of all in London. But whatever the actual meat consumption may be, in all civilized countries, the working classes have as far as practicable arrived at a tolerably uniform diet. They have all adopted a diet yielding not less than 3000 calories and 120 grammes of proteid. It is inconceivable that they should all, under the most diverse conditions, have fallen into the same mistake; such a unanimity means no mistake but a physiological discovery.

Uniform Diet.

Unable to derive any support from the customs and usages of European or American peoples, Chittenden falls back on the Japanese, who are in these days in evidence in all discussions on human affairs. The diet of the great bulk of the Japanese, he says, has been characterized by a very low proteid standard, and this fact is adduced as confirmatory on the large scale of the perfect safety of lowering the proteid food to the physiological

level he has fixed. Quoting Kintaro Oshima, he says: "It is probably fair to infer that the amount of proteid in the dietary of the classes living largely on vegetable foods (and they constitute the larger part of the population) may not be far from 60 grammes per day." But the body-weight of Oshima's subjects was certainly on the average one-fourth less than Chittenden's standard man of 70 kilograms, so that accepting Oshima's figures and taking the criterion of body-weight which Chittenden invariably selects, their proteid consumption was in proportion to body-weight about 75 grammes a day, or one-fourth above Chittenden's required intake. But the body-weight criterion in relation to food is not altogether trustworthy. The shape or build of the body must also be taken into consideration, and shape and build resolve themselves into a question of surface. The larger the surface of the body, the greater is the amount of heat lost by radiation, and the greater the amount of food required to maintain its temperature. Taking, then, the extent of body surface in a short Japanese in

A Japanese Authority.

Radiation.

comparison with that of a tall Englishman, we find that in proportion to that his proteid intake, according to Oshima, is well up to the Voit standard. Then, considering the difficulty of estimating the dietaries of the different classes in this country, it may be doubted whether Oshima's calculations are strictly reliable.

Mixed Diet.

Chittenden admits that a mixed diet with a larger proportion of animal food might offer some advantages to the Japanese from the standpoint of palatability and variety, but he questions if any material gain in health and strength would result. But is it not possible that their abandonment of a meat diet under the influence of Buddhism, 1000 years ago, may have had something to do with their diminutive stature and long-continued unprogressiveness? The permission to eat fish, though that, too, entailed the taking of life, which is contrary to strict Buddhist tenets, was a concession to human frailty, and the desire for animal proteid has in recent times led to pious frauds under cover of this privilege. "One may now see," says Mr. Basil Chamberlain, who has an intimate

Pious Frauds.

knowledge of Japan, "the terms 'mountain whale' (yama kujira) written up over certain eating-houses, which means that venison is there for sale. The logical process is this: Fish may be eaten; the whale is a fish; therefore, if you call venison mountain whale, you may eat venison."

This, at any rate, is certain, that with the departure of the old *régime* the prohibition against eating flesh has been swept away; and that coincident with the rapid and remarkable rise of Japan amongst the nations, there has been a vastly increased consumption of animal food by the best people. Large classes under the sway of inherited food tastes or prejudices still abstain from it, but amongst the affluent and well-to-do classes in the towns vegetarianism does not survive. The latter have, as a rule, three meals a day; the first consists chiefly of dishes made from Soya beans flavoured with different vegetables, such as myso soup and pickles; the second includes fish boiled in soup, stewed vegetables, omelette, pickles, and boiled rice; the third consists of bean-curd soup, boiled rice, and

The Rise of Japan.

chestnuts, fruit, butcher's meat, fowl, and raw fish. The Anglican alliance is now typified by the popularity of beef steak with mustard and Worcester sauce. The dietary of the Japanese Navy was, I understand, revised in 1884, and its proteid constituents raised to a point which, in proportion to body-weight, is equal to that of our own Navy; and as regards the Army, Dr. Arthur Gamgee tells me that the troops during the war had a more abundant proteid diet than any other army in the field has ever enjoyed.

The Anglican Alliance.

His Honour K. Yamagawa, formerly President of the Imperial University of Tokio and Member of the House of Peers, writes to me, "It is commonly believed that we Japanese take less nitrogen food than is necessary. It seems to me, however, that the point is by no means absolutely settled, and that further experiments and observations must be made. We eat fish-flesh perhaps more than any other nation, and I am inclined to think that we consume more proteid from the leguminosæ even than the Chinese, who are supposed to be the greatest eaters of peas and beans in

Nitrogen Food.

the world. Our peasants, especially those who live far from the sea, eat enormous quantities of vegetable food, no doubt to take in the necessary quantity of nitrogen from food poor in proteid. It is a well-known fact that the peasant conscript, when he first enters the barracks, experiences a keen sense of hunger. The food allowed to our soldiers is richer in proteid than that of the average peasant, but the quantity or bulk is much smaller, which is no doubt unsatisfactory to the distended stomach of the peasant. All this goes to show that the quantity of proteid taken by the Japanese is not so small as is popularly believed."

Peasants' Food.

I am happy to say that Mr. Yamagawa is at this time investigating the dietary habits of the Japanese. So we may shortly expect from him exact and trustworthy information on the subject.

Yamagawa's Investigations.

The Japanese are, like ourselves, inhabitants of the temperate zone, but even in the Tropics, where the diet adopted under instinctive guidance contains relatively less proteid and fat and more carbohydrates, especially sugar, than that of the inhabitants of colder regions, we

have indications that the Chittenden standard will not do. Dr. Ziemann, who has recently made a careful study of the hygienic conditions of tropical Africa, states that one of the most influential of the causes which tend to diminish the number and impoverish the physique of the coloured races is not over- but under-feeding. The supply of animal proteids is almost invariably inadequate, while that of the carbohydrates is very irregular, partly because the natives do not cultivate products—such as rice and maize—which could be preserved after the harvest, but only the more perishable bananas and manioc. As regards the white races, Dr. Ziemann says the problem of climate is largely the maintenance of the proper balance between the intake and output of heat. Theoretically, the problem could be solved by a diminution of the amount of food taken or by increase in the muscular activity, but these methods if carried to an extreme lead to the ruin of the white races. The amount of food taken can, it is true, be diminished to some extent and the nature of the food taken can be chosen

Tropical Africa.

Dr. Ziemann's Opinion.

to suit the climate with the utmost advantage, but it is found that the amount of proteid taken by a white man cannot safely be less than 100 grammes a day; that is to say, nearly double Chittenden's temperate zone standard. On the other hand, fat, 1 gramme of which corresponds to 9·3 calories, and alcohol, of which 1 gramme corresponds to 7 calories, are both to be avoided.

A Historical Survey.

A thorough historical survey of food customs in connection with human development and character, and having regard to geographical situation, religious beliefs, and climatic conditions, still remains to be made.

The diminished precariousness of food as wandering tribes advanced from the hunting to the agricultural state had, Buckle affirms, momentous moral consequences by diminishing dependence on mere chance, and opening the mind to a conception of the stability of events and the laws of Nature; while of all physical agents by which the increase of population is affected, food is, according to him, the most active and universal. Where the national food is cheap and abundant,

Physical Agents.

Buckle said—but he wrote before the advent of neo-Malthusianism—population inevitably increases more rapidly than where it is scarce and dear. Among nations, he says, where the coldness of the climate renders a highly animal diet essential, there is for the most part displayed, even in the infancy of society, a bolder and more adventurous spirit than among other nations whose ordinary vegetable nutriment is easily obtained, and indeed is supplied to them by the bounty of Nature gratuitously and without a struggle "The skilful practitioners of the medical art," says Gibbon in his scornful way, "will determine, if they can, how far the temper of the human mind may be affected by the use of animal or of vegetable food; and whether the common association of carnivorous and cruel deserves to be considered in any other light than that of an innocent, perhaps salutary, prejudice of mankind." Rousseau had no doubt about the matter: "Il est certain," he said, "les grands mangeurs de viande sont en général cruel et féroces plus que les autres hommes." However that may be, in whatever

Nature's Bounty.

direction the temper of the mind may be bent by animal or vegetable diet, it is clear that animal food has played a decisive part in human evolution, and that the craving for it has largely contributed to the advance of civilization. That craving led to the invention of weapons and traps of many kinds, to the arts of fishing and hunting, to migration, travel and adventure, to the patient pursuit the taming and domestication of wild creatures and to provision for their wants; and success in the satisfaction of that craving has always been followed by advancement, alike in the arts of war and peace. A diet rich in proteid makes for physical and mental energy and it is not vegetable proteid—always poor in amount in proportion to the bulk of food eaten, difficult of absorption and probably of special, and from a nutritive point of view inferior, constitution—but animal proteid that is required. It is animal proteid that is the true food of the brain and nerves; and hence all the more energetic races of the world and those most distinguished for intellectual capacity have been meat-eaters.

Proteid Craving.

The True Brain Food.

In this connection it seemed to me that it would be interesting to ascertain what were the food habits of the ancient Greeks in their palmy days. They were, as Dr. Galton has shown, the finest race physically and mentally of whom history bears record. "Their masterpieces in the principal departments of intellectual activity are still unsurpassed, in many respects unequalled, and the population that gave birth to the creators of these masterpieces was very small." Athens built up a magnificent breed of human animals, which in the course of one century—530 to 430 B.C.—produced groups of statesmen and commanders, of literary and scientific men, of poets and sculptors, illustrious in quality and in quantity, far exceeding anything that has ever been produced by any other race. Out of about 135,000 males born in that one century there sprang Themistocles, Miltiades, Aristides, Cimon, Pericles, Thucydides, Socrates, Xenophon, Plato, Æschylus, Sophocles, Euripides, Aristophanes, and Phidias.

The Ancient Greeks.

Well, what were the food habits of the race thus prolific of greatness? Through

Food and Greatness

the kindness of my friend Professor Edgar, of St. Andrews University, I have been furnished with a large amount of information bearing on the subject, too voluminous to be introduced here, but which I hope to make use of on another occasion. And that information establishes beyond doubt that these food habits were not abstemious, and that vegetarianism and the Chittenden standard had no vogue in Athens. In Homeric times the meals were more generous than dainty. Pieces of beef, mutton, goat-flesh, or pork, roasted on the spit, were placed by the maid-servants on little tables before the guests, the bread was handed round in baskets, and at the end of the meal wine was drunk, which had previously been mixed with water. In the time of Pericles the diet of the lower classes consisted of barley paste or bread (wheat bread being a delicacy), salad, onions, beans, lentils, meats variously prepared, and fish mostly from the sea. The richer classes indulged in a dessert of piquant dishes, which encouraged drinking, cheese, cakes sprinkled with salt, dried figs, almonds, spices, and fruits.

Homeric Meals.

Ancient Banquets.

In later times, and especially in Magna Græcia, the banquets became more sumptuous. On paintings at Pompeii there are representations of fruits, shell-fish, cranes, partridges, eels, ducks, fowls, kid, and pig. Aristophanes, of the time of Pericles, whose ideal was, as Jebb says, the plain, sturdy citizen of the old school, abounds in references to rich and savoury dishes. In the "Acharnians," written when there was scarcity owing to the war, the Bœotian countryman enters, bringing to the market, according to his own account, "ducks, jackdaws, coots, sandpipers, also geese, hares, foxes, hedgehogs, Copaic eels." "Eels, a fish most delightful to me," says the Athenian. "Bring me the pigeons and the thrushes, and give me a little dish of hare's flesh, verily I shall eat up the hare soup before dinner" (an interesting indication of the appreciation at that time of the digestive value of a little meat soup or extract as a prelude to that meal).

References in Greek Drama.

In the "Knights," Aristophanes refers to the Athenian public as "bean-fed surly Demos," and we have the Flatterers plying old Demos with favours: "See, I am

bringing you this barley scone," "and I bread-spoons," "and I pea-soup," "this slice of salt fish," "flesh boiled with broth, a slice of tripe and belly and paunch." In the "Ecclesiazusæ" we read: "It is now time to retire to dinner, and presently there will come [the Greek is a compound word of seventy-seven syllables] an oyster—salt fish, skate—shark—remainder of heads dressed with vinegar—leek mixed with honey—thrush — blackbird — pigeon — roasted cock's brains—wag-tail—cushat—hare stewed in new wine and seasoned with green corn —with its shoulders fricasseed; so quickly take a bowl of pea-soup"—a tolerably elaborate and copious menu.

An Epicurean Mélange.

For winning the race from the temple of Dionysius to that of Athena the victor received a large bowl containing wine and honey, cheese and olive oil. A passage in Plato's "Laws" shows that the idea of abstaining from meat altogether seemed an anomaly to the Athenian of the fourth century B.C. Speaking of the origin of the human race and of moral ideas, the Athenian in the dialogue says: "Well, and have there not been

Plato's "Laws."

Cleinias the Cretan.

constitutions and distractions of states, and all sorts of pursuits both orderly and disorderly, and diverse desires of meats and fruits, always and in all the world, and all sorts of changes in the seasons, in which animals may be expected to have undergone innumerable transformations?" Cleinias, a Cretan, answers: "Certainly." Athenian: "And may we not suppose that vines appeared, and also olives and the gifts of Demeter and Ceres (*i.e.* corn), and that before they existed animals took to devouring each other as they do still?" Cleinias: "True." Athenian: "And the practice of men sacrificing one another still exists among many nations; and on the other hand, we hear of other human beings who did not venture to taste the flesh of a cow, and had no animal sacrifices, but only cakes and fruits swimming in honey, and similar pure offerings, but no flesh or animals; from these they abstained under the idea that they ought not to eat them, and might not stain the altars of the gods with blood. In former days men are said to have lived a sort of

The Orphic Life.

Orphic life, having the use of all lifeless

things, but abstaining from all living things." Cleinias: "Such has been the constant tradition and is very likely true." In another place the Athenian says interrogatively: "The appetite for meat is necessary, so far as it may contribute to a good habit of body?" And the response is: "Certainly." In the "Laws," Plato did not wish the citizens of his Utopia to sell, but he provides that barley, wheat in flour, or any other kind of food shall be sold by strangers, in the market-place of strangers, making an exchange of wine and food. "And butchers shall likewise offer for sale dismembered animals to the strangers and artizans and their servants."

Spartan Endurance.

The culture of the Greeks, not less than the courage and endurance of the Spartans, was assuredly nourished on a diet into which animal food entered liberally, especially when the climate of Greece is taken into consideration. They adopted and adhered to a diet which established a high type of nutrition, which did not unduly consume nerve energy in the operations of the stomach and intestines, but left it free for that

High Intelligence.

brain work which, according to Galton, lifted them as far above the average ability of mankind as our grade of intelligence to-day raises us above the African negro. Their moderately concentrated and easily assimilated food was especially well adapted to persons following intellectual pursuits, and no inconveniences or evil consequences seem to have resulted from it. We do not hear of their being plagued by dyspepsia or the faulty metabolism of lithæmia, and their decline and fall — which was a misfortune to humanity, and indefinitely retarded and deflected the progress of civilization — was not attributable to over-eating. The Syracusan War drained Athens, and moral laxity enfeebled her, but it was,

Ruined by Mosquitoes.

it now seems clear, the insignificant mosquito that compassed her ruin. Mr. W. H. S. Jones and Mr. G. G. Ellett have shown that it is in the highest degree probable that the deterioration of the Greeks in the fourth century B.C., their abandonment of belief in religion, a future life, and the value of patriotism, was brought about by the introduction and spreading amongst them of malaria, for

the diffusion of which the configuration of the country affords special facilities. Malarial Diffusion.

The Greeks assuredly were not low proteid feeders, nor has any truly great nation or body of men ever been of that persuasion.

# CHAPTER III

## PRISON EXPERIENCES

AS far as I am aware, Chittenden's low proteid diet has not as yet been put to the test beyond the precincts of the laboratory, certainly not on a large scale, but I am able to quote an experiment of a somewhat comprehensive description carried out long before it was dreamt of, and which throws rather a lurid light upon it, and illustrates the danger of trusting too implicitly to theoretical and scientifically arranged diets. I allude to our prison experiences in this country. Up till 1898 scales of dietary were observed in local and convict prisons in England, that had been sanctioned by a Committee of the Home Office, acting with the advice of the late Dr. Edward Smith, the most eminent dietetic authority then living—indeed, the Chittenden of

Laboratory Tests.

Prison Dietary Scales.

the period. No fault was found with these dietaries, none at least audible beyond the prison walls, and it was understood that they were physiologically correct and practically sufficient, until the Prison Bill came up for discussion in the House of Commons in the year named, when a terrible indictment was brought against them. The Right Hon. John Burns told the House, "I have had No. 1 diet, bread and oatmeal. . . . I went into prison with a strong constitution and I was there for six weeks. I never made any complaint. But what is 6 oz. of bread? It is as much as hon. gentlemen take with their chop and potatoes, and cabbage and spinach. I had the bread at 5.30 p.m. and nothing till 7.45 next morning. I am not ashamed to say that at 1 or 2 o'clock in the morning I have wetted my hands with my spittle and gone down on my hands and knees in the hope of picking up a stray crumb from the meal I had had ten hours before. By that diet you break down and enfeeble a man's constitution."

Mr. Burns' Experience.

Mr. Davitt, then M.P. for South Mayo, bore testimony as to convict prison

Star Prisoners.

Inadequacy.

dietaries, and speaking of the full diet for Star prisoners given indiscriminately to all, old and young, weak and strong, said, "It may be enough in many cases, I admit, but most certainly it is not enough in most cases where hard work is a daily task." With regard to punishment diet in convict prisons he said, "I have seen men coming out of the cells at Dartmoor go down to the bone-shed where I was employed, and literally eat the putrid marrow from the bones, because they were suffering from the terrible pangs of hunger. I have seen them pick up fragments of candles, purposely made offensive so as not to be eaten, wipe them with their clothes, and eat them."

Fenians at Portland.

Mr. T. P. O'Connor, M.P., quoting the Member for Westmeath, affirmed that the Fenian prisoners at Portland suffered chronically from starvation, and he had himself gone round and "seen these men gathering and eating snails, so terrible were the pangs of hunger."

These statements, notwithstanding that they were partially confirmed at the very moment by the gruesome but powerful "Ballad of Reading Gaol," were of course

declared to be exaggerated and highly coloured. But they could not be altogether thrust aside. Mr. Asquith said that, regarding No. 1 diet, he had looked into the matter and taken some medical evidence and was inclined to think that there might be some improvement, and the result was that a Departmental Committee was appointed by the then Home Secretary, Sir Matthew White Ridley, to examine and report whether the existing prison dietary could be maintained without injury to the constitution, or impairment of normal health of the prisoners subjected to it.

Mr. Asquith's Statement.

The three members constituting the Committee, two of them in the prison service, were certainly not biased against the existing system, but they had to report, after a searching inquiry, that in local prisons the diets of Class I. and Class II., having regard to the labour on which prisoners were employed, were both inadequate, and that as regards the diet of male convicts the breakfast and supper meals were insufficient, while the element of fat in the dietary was deficient, and more variety of food was desirable.

Insufficient Meals.

An Unfavourable Report.

"We have no hesitation in saying," they wrote, "that judged from the standpoint of gain or loss in weight, the local prison dietary, under the present system of progressive application, has not proved altogether successful, especially in the intermediate sentences."

Now, what were the prison diets that were thus impugned and condemned? The No. 1 diet which caused the President of the Local Government Board such acute suffering gave 57 grammes of proteid, 341 of carbohydrates, 19 of fat, and 21 of mineral matter, with a fuel value of 1464 calories, and was therefore just up to the Chittenden standard in proteid; and the Class II. diet which the Committee judged inadequate gave 70 grammes of proteid, 385 of carbohydrates, 21 of fat, 32 of mineral matter, with a fuel value of 1684 calories, and therefore was considerably above the Chittenden standard in proteid. I have not the figures for the convict punishment diet which so grievously distressed those subjected to it, even for brief periods, but the convict diet for light labour, which I take to be equivalent to the full Star diet which Mr. Davitt thought

The Various Classes.

was not enough in certain cases, gave 133 grammes of proteid, 478 of carbohydrates, 44 of fat, and 34 of mineral matter, with a fuel value of 2398 calories.

Low Proteid.

It was clearly proved by the inquiry that took place, that the low proteid diets, low and yet ample according to Chittenden's computation (and it is to be remembered he teaches that we may also greatly diminish our carbohydrate supplies without detriment), were, under the depressing and monotonous conditions of prison life, painfully afflictive to those subjected to them, and injurious to health, as indicated by loss of weight. It appeared also that many of the prisoners suffered from gastro-intestinal disturbance, as did the dogs which Munk and Rosenheim, in their experiments, fed on a low proteid ration. But the mischief done by these semi-starvation diets was probably great and far-reaching beyond anything that was brought to light. We have no knowledge of prisoners' health after they leave the prison, and it is only fair to infer that a certain proportion of them, especially amongst the young, were broken down in health by the dietetic privation they

Munk and Rosenheim Experiments.

Starvation and Insanity.

there underwent, and suffered subsequently from maladies induced by impaired nutrition. Mr. T. P. O'Connor affirmed that starvation, combined with solitude and punishment, was responsible for much of the insanity found in prisons, the ratio of which arising amongst persons apparently sane on admission was, according to Dr. Bridges, the Local Government Board Inspector, not less than three times as great as that in the general population. But in this connection it must be borne in mind that, while the restricted prison diet may have developed insanity in a few hereditarily predisposed to it or with already damaged nervous systems, a large proportion of our criminal population is congenitally weak-minded. Sir E. Ruggles-Brise, the Prison Inspector, said "that it is so with the bulk of the recidivists. I should call it moral imbecility. They are known as 'half-sharps.'" Mr. Brockway, of Elmira, speaking after a personal knowledge of 50,000 criminals, said: "They belong to the grade of humanity which is inferior." But a more likely sequence of an injuriously low diet than insanity is tuberculosis, and I

"Half-Sharps."

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remember being struck, when Medical Director of the West Riding Asylum, by the number of patients received from the prison who laboured under or speedily developed phthisis, although it was of course impossible to say that that was of prison origin. But that prison punishments, as at one time inflicted—no doubt with humane and reformatory, if sadly mistaken notions—did run the immediate risk of inducing tuberculosis, and of sapping constitutional vigour, I have no doubt. The late Mr. Dyson Wood, when assistant medical officer of the West Riding Prison, made some observations for me on the effects of the then routine punishment of three days in a dark cell with bread and water and found the loss of weight was always considerable, and in some cases amounted to 3 lbs. A sudden loss of weight of that amount in three days in a man already probably much reduced by prison fare and discipline must have placed his health in jeopardy Shylock demanded a pound of flesh, but here were we systematically slicing three pounds off our erring brethren. This punishment could be repeated after an

Phthisis.

Punishment.

Worse than Shylock.

interval of a few days, and was so, I believe, in obstinate cases. Dr. Dunlop found that when prisoners in prisons in Scotland were reduced to 3500 calories of food energy per day, 82 per cent. of them of average size distinctly lost weight. It took from 3500, to 3900 calories to keep prisoners in health and vigour.

Dr. Gautier on Dietetics.

In reviewing the administrative regimen of the prisons in France, which allows 94 grammes of proteid, 22 of fat, and 374 of carbohydrates, and corresponds with 2074 calories, Dr. Gautier, the most authoritative French writer on dietetics, says that it is too poor in meat, is scarcely sufficient for the man who does not work, and *à fortiori* for one who does work, and yet this regimen gives one-third more proteid than the Chittenden standard. Dr. Gautier lays it down as obligatory that the prisoner who does not work should have 80 grammes of proteid, 40 of fat, and 400 of starchy matter, and that the prisoner who does fatiguing work should have, like an ordinary workman, 135 of proteid, and from 500 to 700 of ternary matters—that is to say again, more than double the Chittenden standard.

In Prussia too, in prisons under the jurisdiction of the Minister of Justice, prisoners were given on an average per day 43 grammes of meat, 650 of bread, and 23 of fat—a diet which was found altogether insufficient. In Prussia.

It appears that pretty generally the conviction that eating is one of the chief pleasures of life has led to much too close shaving in diet in the application of punitive measures. Of course prisoners must be punished. They must not be pampered; there must be no pandering to their palates; but there may be and is plenty of punishment without inanition, and the comparison between their diet and that of the honest labouring man of the poorest class outside the prison is entirely misleading and unjustifiable. We know now from the Rt. Hon. Charles Booth and Mr. Rowntree that a considerable number of our unskilled labouring population are poverty-stricken and chronically under-fed, not perhaps to such an extent as to cause immediate physical suffering from lack of food, but yet enough to diminish working power and to lead ultimately to impairment of health. But Sans Inanition.

Economy and Justice.

surely that is no reason why we should run the risk of permanently damaging our criminals who are in durance vile for a time. It is levelling up outside the prison, and not levelling down within it, that is wanted. Economy, not less than humanity and justice, demands that every prisoner should be placed in sound hygienic conditions, and should be sufficiently fed, so that he may do some useful work while in prison, and may not, when he is set at liberty, go to swell the great army of degenerates and incapables who have to be maintained out of the public funds. Then imprisonment is to be not merely punitive but reformatory, and happily the reformatory conception in connection with it is coming more and more to the fore, and if imprisonment is to prove reformatory and give a favourable opportunity to moral and industrial influences, it must involve no deficiency in alimentation. Some of the saints have found sanctity in starvation, and occasional voluntary fasting has ethical benefits, but as a rule a low state of nutrition is accompanied by torpor or perversion of conscience, and famine has not rarely

The Incapables.

brought rapine in its train. Nothing is more demoralizing than chronic hunger. The best-fed races and classes are always the best tempered.

Feeding and Temper.

# CHAPTER IV

## PUBLIC HEALTH

DURING the siege of Paris (1870–71) the quantity of proteid absorbed by the population, to a large extent deprived of meat, vegetables and bread, was certainly less than half the usual quantity, the official ration being fixed at 30 grammes of horse-flesh and 120 grammes of bread, food to which each inhabitant could, if he had the money, add a little fat, rice, preserved fruits or wine, and the consequence of this was the Commune. "The love of purposeless destruction exhibited by the Paris Communists," says Dr. King Chambers, "may be fairly credited to deficient food. No well-fed people could have wrecked the Vendôme Column or burnt the Town Hall and Tuileries, of which they were so proud.

The Commune.

They were like hungry children smashing their dolls."

Public Institutions.

As regards the diet in other public institutions, we have less information than in the case of prisons. There can be no doubt that in the past the prevalence of phthisis and scrofula in many of them was due to bad feeding, and Dr. Robert Hutchison suggests that the outbreaks of ophthalmia which have occurred from time to time in Poor Law Schools may have been attributable to defective diet rather than to overcrowding. There is every reason to believe that the diet in almost all public institutions in this country is now good and sufficient, although often wanting in variety, but the matter must be jealously watched, as of course in most public institutions there is an inclination to reduce expenditure, and should Fletcher and Chittenden notions get abroad, some of them might try to substitute chewing for solid food. That this warning is not unnecessary appears from Mr. Horace Fletcher's perhaps somewhat inflated and premature statements that "Professor Chittenden's results have been accepted in scientific circles the world over as

Inflated Statements.

authoritatively conclusive," and that "the Public Health Boards of Europe are planning to put the new standards of dietary economy into practical use, amongst public charges, in a manner that can only result in benefit to the wards of the nations as well as make an important saving to the taxpayer."

The Chittenden Vortex

But whatever the Public Health Boards of Europe may be doing, it is satisfactory to know that the Health Boards in this country have not yet been drawn into the Chittenden vortex, and that the wards of our nation are in no immediate danger of being put on half proteid rations. The new General Order of the Local Government Board, which came into force in 1901, prescribes a diet good and sufficient on the whole. Our soldiers, whose food supplies have been recently revised by Lieutenant-Colonel Davies, to whom I am indebted for much interesting information respecting them, receive, I am glad to say, allowances which must be regarded as adequate, but by no means excessive from the orthodox point of view. Taking the Guards in London (and where in the world will be seen a

Soldiers' Mess.

body of men of more splendid physique or in better condition?), they, like other soldiers, have food derived from three sources, namely, (1) rations; (2) messing allowances; and (3) private purchases. The ration is of course a fixed quantity, and the messing allowance of threepence a day must be expended under the orders of the commanding officer on food, but the private purchases of food vary very considerably in accordance with individual tastes and local circumstances, and are particularly difficult to estimate in the case of the Guards, who largely resort to eating-houses for supper, instead of obtaining them at their own regimental coffee shop. It is not easy, Lieutenant-Colonel Davies says, to determine the nutritive value of these "fancy suppers," but he has approximately done so, and taking absolutely the least expenditure out of the man's own pocket, he finds that the food of a guardsman, derived from all sources, gives 134 grammes of proteid, 130 grammes of fat, and 410 grammes of carbohydrate, with an energy value in large calories of 3398. This is, Lieutenant-Colonel Davies says, the minimum,

Private Purchases.

Fancy Suppers.

and certainly lower than the truth, and we see by it that the Guards have a proteid allowance somewhat above the Voit standard. Lieutenant-Colonel Davies tells me that some careful observations made recently by Dr. Pembery and Captain Parker on the dietary of troops at Aldershot have shown in different bodies of troops daily averages of proteid from 123 to 142 grammes, fat 105 to 131 grammes, and carbohydrate from 412 to 461 grammes, with fuel value of from 3248 to 3478 calories. In respect of the soldier's diet, a most important concession has been made by Mr. Haldane within the last few months on the recommendation of a scientific committee of which Lieutenant-Colonel Davies was a member. The messing allowance of threepence a day is now granted for the recruit as well as for the trained soldier, and obviously the growing recruit needs it quite as much as, if not more than, the developed soldier.

Guards' Proteid Allowance.

In the Navy, as in the Army, besides the standard rations, a messing allowance, in this case fourpence a day, is given, and the men supplement the food obtained

The Navy.

in these ways by private purchases. I have not been able to obtain any figures representing the food obtained by the messing allowance or privately, but Sir Herbert Ellis has been good enough to give me the daily standard ration for service afloat, and that works out at 96 grammes proteid, 33 grammes fat, 442 grammes carbohydrate, and 15 grammes salts. This diet is poor in proteid and fats, although nearly double the Chittenden standard, but the messing allowance is, it is understood, spent on substances rich in these, so that the diet might be raised by one-fourth in proteid, which would thus be up to the Army level, and by a much larger proportion in fat.

Poor in Proteid.

But according to Fletcherism, upon which Chittenden founds, these men are being hugely overfed, and are being insidiously rendered stupid and inefficient, and committed to many ills, gastro-intestinal disturbance, indigestion, toxæmia, liver troubles, gout, rheumatism, and other ailments, all the offspring of too much proteid. The true way to reduce our bloated Army and Navy Estimates is, it would seem, not to cut down batteries

Hugely Overfed.

of artillery and reduce the number of the forces, but to dock Tom Bowling and Tommy Atkins' ration by one half. They might not like it at first, but they would doubtless become reconciled to it when they discovered the corporeal lightness and intellectual clarity that result, or are alleged to result, from being reduced to a food consumption in strict harmony with physiological requirements and kept clear of waste products. As for our prisoners, they ought to be as jolly as sandboys on the old diets, if they could only be induced to chew with assiduity.

Absence of Breakfast.

Not only by their fruits, but by their follies shall ye know them, and it is instructive to follow Fletcherism a little way and note how, like Falstaff's rogues in buckram, it grows and grows as it rolls on—a characteristic trait of the fads. One of the most prominent changes introduced by his system, Mr. Fletcher tells us, is the absence of appetite for breakfast, which enables a good day's work to be done before the mid-day meal. In cases where there is a sedentary occupation, he goes on, without any great amount of physical exertion, there is commonly a call for

only one meal in the day, somewhere about mid-day. A little later we have it that where there is no appetite it is far better to refrain from taking food, even for so long an interval as two or three days, provided always there is no uneasiness or fear of the consequences. It is usually advisable under such circumstances to go to bed, especially if there is much acidity. Dr. Hericourt, of Paris, we are then told, recommends that in bad cases of dyspepsia it is advisable to put the patient to bed for a week or ten days without food. Dr. Dewey tells of a patient who after only a seventeen days' fast was reduced from 180 lbs. to 122½ lbs. But this is mere trifling beside the methods of Mr. Edward Carrington, who, for the cure of certain ailments, causes his patients to undergo protracted fasts of thirty, forty, fifty days, and even longer, during which they have only occasional sips of water.

One Meal a Day.

Fasting.

All this reminds us of the lamented Dr. Stark, who, a hundred years ago, lived for forty-four days on bread and water; for a month on bread, water, and sugar; and for three weeks on bread,

water, and olive oil, and then developed scurvy and died a martyr, we are told—surely a somewhat superfluous martyr—to science.

Superfluous Martyrdom.

One would rather not characterize such extravagance as it deserves, but dangerous extravagance it must appear to those who have watched the effects of the refusal of food, even for short periods, in the insane, or who have a firm grasp of the old precepts of physiology. The whole thing tends to hypochondria and delusion, and we are not surprised, therefore, to find Mr. Fletcher speculating that his method, by diminishing the quantity of waste, might finally do away with the lower intestines altogether, from the same cause that makes any unused member of the body, and also unnourished members, shrivel and disappear in time. We are thus shown, not a short cut, but an ultimate escape from appendicitis.

Extinction of Appendicitis.

Occasional brief fasts, as has been said, may be salutary, both in a moral and material sense, and an interruption in the monotonous regularity of one's meals now and then may whet appetite and digestion; but the deprivations

recommended by Mr. Fletcher and his followers, however miraculous they may seem in their severity, and in their effects on certain neurotic subjects, can only on the large scale prove hurtful and destructive of health, and abbreviative of life.

Life is really a little too short for Fletcherism. Busy men cannot afford to go to bed for two or three days and starve whenever there is loss of appetite, nor can they devote a large portion of their lives to mastication. No doubt Mr. Fletcher says that he can get through one of his miniature meals in a quarter of an hour, but in another place he tells us that one-fifth of an ounce of the mid-way section of the young garden onion, sometimes called "shallot," required *722* mastications before disappearing through involuntary swallowing, and Dr. Kellogg describes the case of a patient of his who, while being Fletcherized, spent never less than an hour and a half in chewing his one small meal a day. Vita Brevis.

But Chittenden's work and writings are of a very different nature from those of Fletcher and his more ardent disciples,

and must command the serious consideration of physiologists. His three series of original experiments to which I have referred, one on a group of five University men, extending over eighteen months, another on a group of thirteen men of the Hospital Corps of the United States Army, extending over six months, and a third on a group of eight students, all trained athletes, extending over five months, and involving in each case an exact daily estimate of the nitrogen intake and output, make it evident that under certain conditions grown men can physically thrive for a time on an amount of proteid far below the generally accepted dietary standards, and far below the amount called for by the acquired tastes of mankind. In the professional men on a dietary of three meals a day, varied somewhat from day to day, but consisting generally of bread, fruit, coffee, sugar, cream, potatoes, with a total nitrogen content of from 6 to 7 grammes, corresponding to about 37 grammes of proteid food, body weight was maintained, nitrogen equilibrium established, health enjoyed with an average daily metabolism

Experiments.

Professional Men.

of from 5·4 to 8·99 grains of nitrogen and without any perceptible impairment of working power. The Army Corps men on a similarly restricted diet remained in sound health and showed a general gain in working power, and the athletes, accustomed to a large proteid consumption, when cut down by one-half showed, without exception, an improvement in muscular strength. Army Corps.

But a good deal hinges on the words *for a time.* These men, specially selected, in the prime of life and sound health, living in favourable surroundings under unique conditions, with nicely regulated exercise and dominated by the experimental idea, did well so far, but how about their subsequent history? Have they all voluntarily adhered to the dietary that in the laboratory proved so useful to them, and are they all still as vigorous and efficient as ever? There has not yet been time for any convincing proof of the utility or even safety of the reduced proteid diet, and we shall have a long time to wait for the verification of Chittenden's prediction that it will prolong life. The effects of dietetic habits are not Inutility of Brief Experiments.

made fully apparent in a short period, nor are they easily or speedily nullified by a change of diet. Mr. Hubert Higgins, one of Fletcher's most ardent disciples, tells us that "the British navvy (day labourer), who eats on an average some 2 or 3 lbs. of meat a day, is of little use after 40." That is a double-barrelled assumption, for there is no evidence that the British navvy is effete at 40, or that his regular diet includes that amount of animal food. But suppose the statement to be correct, it indicates that the injurious effects of what Mr. Higgins regards as a highly pernicious diet may be late in making their appearance. The carnivorous navvy must for twenty years have been overloading his system with unnecessary proteid, engaging all the time in labour of the most strenuous description, and it is only at 40 that his sins find him out. Gout is a type of nutrition liable to be acquired by persons who indulge in a certain kind of high feeding, but the gouty tendency only gradually grows under a continuance of the gout-producing diet, until at length it reveals its presence in an arthritic attack.

The British Navvy.

Gout.

Now, if excesses in diet are thus slow in exacting their penalties, may it not be that a subliminal diet may be also tardy in manifesting its untoward effects? May not imperceptible undermining be going on for a long time before there is any obvious collapse? Is it not possible that those who have reduced their diet to the Chittenden standard may persevere in it for months, or years, without apparent detriment, and yet in the long run in some way break down owing to it? The nutrition of the brain-cells is influenced in a very subtle manner by food, and we should require proof that Chittenden's subjects, after a long course of his diet, showed no impairment of mental capacity before we can regard it as altogether free from risk. Miss E. D. Cameron's admirable "Dietary Study of Five Halls of Residents for Students in Edinburgh" showed that the average amounts taken per man—and the men were engaged in study and taking a good deal of physical exercise—were proteid 143 grammes, fats 138 grammes, carbohydrates 511 grammes, with a fuel value of 3979 calories.

Break-downs.

Edinburgh Students.

It is incontestable that a radical change in diet, involving either increase or decrease in amount, cannot be abruptly made either in man or animal without gastro-intestinal troubles and failure in health. May it not be that radical changes gradually introduced may have insidious but deferred effects of a more obstinate kind?

Intestinal Troubles.

There is, I think, a tendency in these experimental days to be a little short-sighted in our physiological views. Immediate results are tabulated; remote consequences are sometimes ignored. We are confronted in every newspaper with testimony to the beneficial effects of strenuous physical exercise, and that athletics of a severe type conduce to immediate and marked muscular development is unquestionable. But what we really want to know is the whole life-history of the athletes, how many of them reach a green old age, and especially how many of those of them who have undergone severe training, and made records in one way or another, succumb prematurely to heart troubles between 40 and 50 or 50 and 60 years of age. I cannot help

Athletes.

fearing that the breaking of records may sometimes end in the breaking of hearts. The revival of physical education, too much neglected since weapons of precision and long range made personal prowess comparatively unimportant for national or personal defence, is much to be welcomed; but it, too, must be pursued in moderation, and the extravagant addiction to it now sometimes witnessed may involve penalties which only time can fully reveal. How many of our centenarians have been athletes in their day? Lord Kelvin, who retained to a great age bodily health and singular mental vigour, never indulged in anything but the most moderate muscular exercise. We must not confuse muscular energy with constitutional vigour.

Records *v.* Hearts.

Lord Kelvin.

But in appraising the probable effects of a reduced proteid intake we must look beyond the individual and consider how it may affect the race. What may be the consequence of a sudden reversal of food customs which have grown up slowly and spontaneously, and along with which there has been advancement? For it cannot be denied that in the Western and

Sudden Reversal.

large proteid-consuming races there has developed an increased precision in mental operations, as seen in the rise and progress of the exact sciences. The effects of a vegetarian diet could not be expected to be fully impressed on the bodily and mental qualities of the race until after such habits had been continued through two or three successive generations. Sir William Roberts said, "I have encountered in Salford, where some years ago there existed a flourishing colony of vegetarians, a tradition to the effect that though vegetarianism might suit the parents it was bad for the children. And I have seen some striking examples in that borough which appeared to indicate that the tradition was well founded."

Sir William Roberts.

Even if it should be fully established, by experiments more extended and varied than those of Chittenden, that nitrogen equilibrium can be maintained on a much smaller amount of proteid than has hitherto been supposed, there would still be a question whether it would be wise and prudent to adopt the minimum amount as the rule of life. With a low proteid supply the organism may have to adapt

Nitrogen Equilibrium.

itself to its situation under conditions of strain. It has a large power of adjusting itself to circumstances, but that power may be overtaxed. We are still without proof that what sufficed for Chittenden's subjects living under exceptional conditions will suffice for ordinary persons (I exclude physiological freaks) living in the common run of civilized life. We are still without proof that Chittenden's subjects did not suffer while under experiment in ways which it is difficult to detect and measure. There was no loss of power, we are assured, but was there not some loss of vivacity? Did they retain their wonted briskness, sprightliness of manner, evenness of temper, and tenacity of memory? Is it quite certain that brain function, which is the most delicate gauge of proteid sufficiency, remained undimmed?

Overtaxed Power.

Brain Function.

Let it be granted that the average amount of proteid food now habitually ingested does considerably exceed the quantity required to maintain exactly metabolic equilibrium, does it follow that it should be lowered to the point at which, according to laboratory observations,

metabolic equilibrium stands steady? Metabolic equilibrium is never steady or at a fixed point. It varies in different individuals and in the same individuals from hour to hour, and it is always safe to allow a margin, and a broad margin. There may be some use in the system for a proteid excess, just as there is for those constituents of vegetable food that are not absorbed. The intestine requires a certain amount of unabsorbed residue as ballast to act as a stimulus to its peristalsis, and when herbivorous animals, such as rabbits, are fed on food which leaves little or no residue, they suffer from affections of the intestines which may prove fatal. May it not be that the surplus of proteid is protective against disease, and that the undoubted diminished resistance of the underfed person to pathogenic organisms is due to the want of the protective influence of those proteids of the blood serum which, as Sir William Allchin has pointed out, are not destined for the nutrition of the tissues, but which nevertheless depend, for their maintenance in the blood, on the proteid food? Not only is proteid starvation manifested in

Ballast.

Sir William Allchin.

diminished resistance to bacterial invasion, but in a general lowering of bodily tone, and debility which may be traced to diminished metabolism, owing to the withdrawal of the stimulus to it which alimentary principles of the proteid class supply. We see how rapidly adipose tissue is disposed of on a meat diet in the treatment of obesity, and we can understand how tissue change hangs fire when the normal stimulus to protoplasmic transformation is wanting. Dr. Galbraith has shown how in pulmonary consumption lymphocytosis which accompanies digestion is much increased by a diet of raw meat, and so a deficiency of proteid ingesta may diminish this lymphocytosis and so prejudice nutrition.

Dr. Galbraith.

# CHAPTER V

## THE STUDY OF ANIMAL FUNCTIONS

Comparative Observations.

NO reasonable person will now deny that an immense amount of light is thrown on human functions by the study of the same functions in the lower animals, and that recent advances in physiological knowledge and the treatment of disease have been mainly due to experimental investigations in creatures of a type very different from that of man. But, at the same time, the degree in which comparative physiological observations are instructive and trustworthy varies vastly in accordance with the nature of the function that is submitted to experiment, and there is, perhaps, no department of vital activity in which there is more need

Conclusions.

of caution in drawing conclusions applicable to man from other species of animals

than in that of nutrition. Digestion seems at first sight almost the simplest of our functions, and can be imitated, in the first stage at any rate, with great precision in a glass bottle in a laboratory, and yet there are, in connection with human digestion, problems of vast interest and importance which we do not encounter at all in the study of the digestion of the lower animals; and as regards the science of dietetics, however helpful physiological researches may prove, it must remain broad-based on the general experience of mankind. Civilized man has departed more and more, in regard to food, from the simplicity and uniformity which characterized his primitive state, whatever that may have been, and which still characterize the food habits of almost all the lower animals, wild or domesticated. He has introduced an extraordinary complexity into his dietary; he has subjected it to all sorts of elaborate preparations and cooking processes; he has added to it articles of a stimulating and restorative nature not themselves endowed with nutrient properties, and yet profoundly influencing nutrition; and he carries on

Simplicity.

Complexity.

digestion and all other nutritive processes, under the sway of the nervous system and psychical impressions, to a degree that is not seen or approached in any other animal.

The Lower Animals.

Digestion and nutrition are altogether simpler and more constant processes in the lower animals than in man. Their food is less varied in character, and the call for adaptational modification of function in the digestive and assimilative apparatus is therefore comparatively trifling. Their higher nerve-centres, simpler in structure and infinitely more limited in their range of function, have less power of regulative control over animal life, and so there is in them less interference by emotional states with the movements and secretions of the alimentary canal and its succursal viscera. Hence they do not suffer from nervous dyspepsia so common amongst civilized mankind, and are less subject to variation in weight, due to ups and downs in the psychical barometer.

Centralization.

As we ascend in the scale of being centralization becomes more and more marked. The autonomy of the different

sections and organs of which the body is composed is not abolished, but is brought under more rigorous control by the central ganglia. The human brain dominates the body to which it is attached, and all subordinate administrations, to a far greater extent and degree than does the brain of any animal, and so digestion and nutrition reflect brain changes in human beings in a way that is never seen amongst the lower animals. Every man and woman has experienced the arrest of digestion and its painful accompaniments by some sudden shock or alarm, and has become acquainted with the beneficent effect of good news and tranquillity on the gastric functions. Every one has witnessed the blighting and wasting effects of sorrow and anxiety, the fattening operations of happiness and ease. Attention has nothing to do with it. No man can by taking thought add energy to his stomach. The nerve currents that keep alimentary processes going seem to flow most freely when attention is distracted, for a dinner that is disposed of with ease and comfort in genial company and amongst

Brain Changes.

Nerve Currents.

Companionship.

interesting conversation, would become a burden and a cause of nightmare if eaten alone and in gastronomic contemplation.

The results of feeding experiments on animals must not, therefore, be too hastily supposed to afford guidance in the feeding of man, and this caution is all the more necessary when it is borne in mind that food-stuffs of the same chemical composition react very differently on even the same animal body. The specific nature and quality of the proteid obviously count for a good deal in nutrition. There are subtle proteid mysteries that are still to be unravelled, but already it is clear that animal and vegetable proteids have very different dietetic values.

Dietetic Values.

The results of Chittenden's experiments on twenty dogs—the details of only six cases have as yet been published—cannot therefore be allowed immediately to upset all received notions, not only as to the proteid allowance necessary for capricious, flavour-hunting, self-indulgent man, but as to that needful for high proteid-feeders amongst animals, more especially as his results run counter

to those of previous experimenters. If Chittenden is right, not only man, but the whole carnivorous creation must have been wrong hitherto in its food habits. Food Habits.

Chittenden's criticisms on the results obtained by Munk and Rosenheim cannot be said to be altogether conclusive. Their experiments were few in number, but they all demonstrated very clearly that a low proteid diet in a high proteid-feeding animal has deleterious effects, inducing loss of appetite, weakness, vomiting, and ending in a loss of power of absorption from the intestine, caused apparently by a change in the condition of the epithelial cells and a diminished secretion of gastric juice. These conclusions, quite in harmony with those bearing on the same point arrived at in other ways, Chittenden discredits on the ground that the dogs experimented on were kept in unhygienic conditions, without sufficient fresh air and exercise, and on a too monotonous diet. Against Munk and Rosenheim he pits Jägerroos, of Finland, who kept two dogs alive for many months on an intake of nitrogen of only 0·29 per kilo; but both Jägerroos's Absorption.

Jägerroos's Dogs.

dogs died, not, he would have us believe, as the result of diminished intake of proteid and inanition, but of some infectious disease to which they quickly succumbed. But if Jägerroos was right in this, it is a fair inference that it was their reduced state of health, induced by poor feeding, that made them susceptible to the infectious disease which carried them off.

Chittenden's own experiments, intended to test the results of previous observers, and to determine definitely the effects of a low proteid diet on dogs, as types of high proteid animals, were conducted under conditions of the most carefully prepared and favourable description. They extended over a year, were regulated with scrupulous care, the results being recorded with scientific precision and in minute detail. They afford, he says, convincing proof that dogs can live and thrive on amounts of proteid and non-nitrogenous food far below the standards set by Munk and Rosenheim. They strengthen his opinion that the dietary habits of mankind and the dietary standards founded thereon are not always

Canine Standards.

in accord with the true physiological requirements of the body.

Chittenden again makes out a strong case, and it may seem presumptuous in any one, without further experimentation, to challenge his conclusions. But even a casual survey of his experiments suggests doubts. He proves rather too much, for in several of the dogs, with the gradual reduction of the nitrogen per kilo of body-weight, there was a gradual increase of body-weight, and one becomes curious to know what the effect of the total withdrawal of nitrogen would have been. Then all the daily averages in the dogs are calculated on body-weight, without any reference to the build or shape of the animal, but the body-weights recorded show that the surface, and consequently the amount of heat lost by radiation, must have varied enormously in the different animals subjected to experiment. One of the dogs weighed 18·3 kilos, and another 15·9, another 9·2, and another only 6·8. Further, the breed of dogs employed is not specified in any case, though the portraits of all of them suggest mongrels; but the point is of

Chittenden's Conclusions.

some moment, for different breeds of dogs are habituated to different kinds of diet, and habit is an important element in relation to diet. Slow sporting dogs, setters and harriers, are fed chiefly on oatmeal and weak broth, but the coursing greyhound is trained on the best beef and mutton. Some domestic pets get little or no meat. Again, the ages of the dogs are not stated, although that is of some significance in relation to growth and repair. In several of the experiments there are indications that, while the nitrogen balance was maintained, the state of health of the animal was unstable and exceptionally liable to be seriously affected by slight changes.

Domestic Pets.

Chittenden's dogs, notwithstanding the nice precautions taken, and although undoubtedly under more healthful conditions than dogs previously experimented on, were still leading an unusual and unnatural life. For ten days each month they were closely confined in the metabolism cage, so that all excreta might be collected with a view to the determination of the nitrogen balance, and at other times they were practically kennelled

Nitrogen Balance.

dogs, with no runs across country, none of the intense excitement felt by the dog in scenting, chasing, or unearthing its prey, or in fighting its kind. They led a placid and cloistered existence, and so asceticism probably suited them. Not until a pack of foxhounds have got satisfactorily through a winter's work on Chittenden's reduced diet can his experiments be accepted as anything more than a curious physiological feat. They cannot be allowed to supplant the practice of all our experienced huntsmen, who have found it expedient to feed their dogs on a diet supplying proteid in much larger amount than do the Munk Rosenheim standards. It is in diminished energy that the effects of a low proteid diet is first manifested in the dog, and that will be seen long before any signs of bodily deterioration present themselves. Dr. Gowland Hopkins noticed that a dog whose proteid ration he cut down, while remaining plump, ceased to frisk and wag his tail.

A Curious Physiological Feat.

Dr. Gowland Hopkins.

But against Chittenden's experiments on half a dozen dogs other more sustained experiments may be quoted, and

the general experience of mankind may be again invoked. The experience of our zoological gardens shows that high proteid animals in confinement require, to keep them in health, a proteid allowance enormously in excess of Chittenden's dogs. A lion weighing 400 lbs. gets 10 lbs. of meat a day, of which on an average 1 lb. is bone. "The lions are also," Dr. Chalmers Mitchell writes to me, "given regularly fresh-cut grass, which they frequently eat, and under special circumstances, for instance females that are pregnant or nursing, milk or cod-liver oil. They are given no meat at all one day each week. This is the routine mode of feeding. Occasionally, when an animal is off its feed, it is given half of a freshly-killed goat, including the skin and viscera. I have no doubt these animals would really do better if they were fed more irregularly: that is to say, given much larger meals and starved for several days; but under menagerie conditions it is rather difficult to make experiments of this kind."

Dr. Chalmers Mitchell.

Irregular Feeding.

Now, 10 lbs. of meat containing 1 lb. of bone gives 907 grammes of proteid, 226

grammes of fat, carbohydrates *nil*, and mineral matter 48 grammes, and this to a lion weighing 400 lbs. gives 2·268 grammes of proteid to each pound of body-weight, 145·15 grammes of total nitrogen to Chittenden's 2 to 6 grammes in the diet of his dogs, or 0·8 gramme of nitrogen per kilo of body-weight against Chittenden's 0·2 to 0·3, with a fuel value, however, of only 27·75 calories per kilo of body-weight against Chittenden's 60 to 80. In comparison with the lion the domesticated dog is really not a high proteid feeder. Body Weights.

But from the dietary of the low proteid consumers, or herbivorous animals, useful lessons may be learned, for here again old experience has attained to something like practical wisdom, and scientific discovery has been anticipated by empirical observation. For ages past farmers have valued and cultivated leguminous crops, the four-course rotation of turnip, barley, clover, wheat having been popular two thousand years ago, but it is not twenty years since Hellriegel and Wilfarth revealed to us that leguminous plants bear on their roots nodosities Empirics.

abounding in bacteria capable of fixing atmospheric nitrogen, and thus supplying the nitrates essential to grain crops.

Cross-breeding.

From the dawn of history men have been engaged in adapting domestic animals to their uses, by making crosses between varieties with differentiating characteristics, and in this country our pedigree herds of cattle attest with what skill and success dominant and recessive characters have been handled by the breeders of stock, but it was only in 1866 that Mendel formulated his law of inheritance in hybrid varieties. Now, it is safe to assume that not less "nous" has gone to the feeding than to the breeding of domestic animals, and that science in the future is more likely to elucidate and explain, than to alter or reverse, the system of regimen now in use. The farmer is the repository of agricultural traditions, but he is obliged in these days to be strictly economical, and is not likely to throw proteid away, so we may derive some useful hints in the matter we are considering from his proceedings.

Mendel.

Milch Cows.

Let us take the case of the milch cow. Any excess in the proteid ration of the

cow above what is necessary to build up and repair the body, and for the production of milk, goes to be converted into fat and deposited as such, and contribute to heat and energy. In efficiency for these purposes it is about the same as the carbohydrates, but it is far more expensive to supply than these, and we may depend upon it, therefore, that the prudent and intelligent farmer gives no more than is requisite to repair the animal machinery, build up tissue in growing animals, and assist in the production of milk. What, then, is the approved recipe for the food of the cow in milk? No doubt the food varies widely in accordance with differences in breed, bulk, stage of milk-giving, and climatic and housing conditions, but I take an average case from the American Tables for Computing Rations of Farm Animals. These give for a cow in milk weighing 1000 lbs. a daily ration of 18 lbs. of hay, 4 lbs. of oats, 4 lbs. of buckwheat, and 2 lbs. of cotton-seed meal. In this diet the total nitrogen is 190·7 grammes per day, and that gives for this low proteid herbivorous animal 0·420 gramme of

Milk.

nitrogen per kilo of body-weight, or about one-third more than Chittenden finds sufficient for his high proteid feeding dogs. The fuel value of the cow's diet per kilo of body-weight is 49,144 large calories.

The Horse.

The feeding of the horse has for centuries been the subject of study and trial in the stables, and has been brought to great perfection. From it, too, some useful dietetic hints may be derived, but I will, as an illustration, cite only one case, that of the London tram-horse doing moderate work. Such a horse, I am informed, weighing 1360 lbs., requires, if it is to be kept in condition and do its work, the following daily diet or its equivalent: 12 lbs. of hay, 4 lbs. of straw, 8 lbs. of maize, and 6 lbs. of oats. Now, this diet corresponds with 2·51 lbs. of proteid, 19·47 lbs. of carbohydrates, 1·14 lb. of fat, and has an energy value of 45,684 large calories. It gives a total nitrogen content of 196·75 grammes, or 0·318 gramme per kilo of body-weight, and a fuel value of 74·05 great calories per kilo of body-weight. Good sustained muscle work is what is sought in this animal, and of that

Fuel Value.

the carbohydrates are probably the chief source, although, as Professor Noel Paton has argued, all constituents of the food may contribute to it; but short, sharp efforts are also demanded of it, and for the production of these proteid is best adapted. The large proteid intake that has been found essential in the low proteid feeder to the maintenance of health and working power is the notable fact. The horse that is fed on grass does not suffer from hunger, but it cannot do hard work. In parts of Australia it has been found that the addition of flesh to the diet of the horse imparts to it, for a time at any rate, unwonted spirit and energy, and makes it equal to tasks which it could not otherwise perform.

Professor Noel Paton.

Domestic animals may be and are, like human beings, over-fed sometimes, as in the case of the pig, with the deliberate intention of securing certain nutritional results, and sometimes, as in the case of pets, from mistaken kindness. It may have disastrous consequences. The Shire Horse Society, some time ago, directed attention to the over-feeding of shire mares, and the regrettable effect it had

Domestic Animals.

on their breeding value. For years past the classes provided for mares have been at once a source of pride and disappointment. In them are invariably to be seen some of the best known and developed specimens of the breed. Now and again a prominent show mare will qualify and duly appear in the brood-mare class, but two years out of three she is exhibited without a foal. If the loss resulting from the infertility of the best mares affected the owners only, it would be serious, but the animals that are the victims of this indiscretion are the choicest specimens of the breed, and precisely those that are best calculated to yield the best class of foals. Yet, instead of their being used in improving their race, they continue year after year to eat the bread of idleness and leave behind them no tangible evidence of their having existed.

Infertility.

What part of the bread of idleness eaten by these mares is responsible for their infertility it is impossible positively to say; but the experiments of Dr. B. P. Watson, communicated to the Royal Society of Edinburgh, suggest that it is

Dr. B. P. Watson.

an excess of proteid that is to blame. Dr. Watson has found that a meat diet is prejudicial to the occurrence of pregnancy in the rat, and that in rats fed on a meat diet the mammary development of nursing mothers is less than in rats fed on bread and milk. Moreover, he has demonstrated that the use of a non-physiological diet, *i.e.* exclusive flesh, rice, or porridge, induces in the great majority of cases a modification in the structure of the lining membrane of the womb, namely, a diminution in the number of the large cells, which are most important in a physiologically active *mucosa;* that this structural change is most profound in animals fed from weaning on an exclusively flesh diet, and is associated with sterility. The normal rats, free from any such structural changes and abundantly fertile and lactiferous, were the wild ones, which had been free to find and select their own food without any laboratory assistance. There is a great gulf between the rodents and the solidungulæ; but it seems not improbable that the infertility of Shire mares may be due to the administration

Pregnancy.

Sterility.

of too much proteid food. Dr. Watson's experiments call to mind the speculations of Fournier and Doubleday — for they were scarcely more than speculations — that those countries are most populous where the food is largely vegetable, because an animal diet is unfavourable to fecundity. It is a significant fact that caries of the teeth in animals is practically limited to mixed feeders, and is extremely rare in the carnivora. The careful investigations of Professor Müller of Berlin University, have shown that the immediate cause of caries is the retention and fermentation of carbohydrate food in and between the teeth, and that proteids are not responsible for caries in enamel or dentine.

Professor Müller.

# CHAPTER VI

## THE VOICE OF NATURE

BUT more authoritative, it may be thought, than any indications given by the diet of animals, must be the voice of Nature herself in relation to human nature. What does she prescribe at a time when no artificial dietetic habits have been formed, when there has been no abnormal stimulation of appetite? What amount of proteid does she allow the infant when feeding on her own patent inimitable food — breast-milk? This reference, if made by Chittenden's own method, is absolutely fatal to his position. His invariable criterion in his experiments is body-weight, and by that criterion he is condemned; for an infant a week old weighing 8½ lbs. consumes daily 400 grammes of mother's breast-milk, giving 8 grammes of proteid, 2·07

Infant Feeding.

Daily Scale.

per kilo of body-weight, 1·32 total nitrogen, and 218·08 calories of fuel value. That is to say, a man weighing 70 kilos, or 154 lbs., would on this infant scale have 145 grammes of proteid per diem, or 27 grammes above the Voit standard, and two and a half times Chittenden's maximum.

But let us try again. An infant six months old and weighing 17 lbs. requires a daily milk ration containing 14 grammes of proteid, 30 grammes of fat, and 59 of carbohydrates, with a fuel value of 559 calories, while an adult man weighing 70 kilos, or 154 lbs., would on the same scale require 122·5 grammes of proteid daily, which is still above the Voit standard and double that of Chittenden.

Fallacious Comparison.

But Dr. Robert Hutchison has argued that the comparison by relative body-weights is fallacious, in taking no account of the much greater relative body surface in the infant in proportion to its size. He has suggested that the proper plan is to take the proportion of total energy supplied in the form of proteid to the infant and calculate what proportion of the 3000 calories consumed daily by an

adult man should be derived from that source. That works out at 110 grammes in comparison with an infant a week old, and at 75 grammes in comparison with one six months old, which in the latter case somewhat approximates to Chittenden's standard, but is still 25 per cent. above it. But Dr. Hutchison's method of attacking the problem cannot be regarded as final, for it assumes that growth in the infant may be set off against wear and tear in an adult, and ignores other differences that render the question a highly complex one. The growth is going on in a very small body, the wear and tear in a very large one, and although proteid is more essential for growth than for work, for which carbohydrates are more suitable, and available as proteid savers, we are not justified in concluding that a less proportion of the total energy should be derived from proteid in the adult than in the infant. The infant not only does no work, but it spends most of its life in sleep, when waste is at a minimum, and the temperature of its body is so maintained and regulated by clothing and proximity to its nurse that the

A Complex Question.

amount of heat lost is much less than in the adult. The leading fact remains that Nature provides this proportionately large proteid intake for the infant without imposing any undue strain upon the excretory organs in removing waste products, which are, we are told, probably more or less toxic.

Nature's Provision.

But as regards these waste products and their toxic effects we have other sources of information. If Chittenden's views are correct, if a reduction in the proteid intake is conducive to health, vigour and endurance, and protective against disease germs and toxic accumulations, we should expect to find a diminished consumption of proteid food beneficial in the treatment of many diseases, particularly in a disease like tuberculosis, in which germs and toxins play so destructive a part, and in which recovery can only take place through the increased resistance to these which reinvigorated health confers. But so far is this from being the case, all trustworthy experience teaches that it is by augmented proteid supplies that we can alone hope to ward off tuberculosis, and to combat

Germs and Toxins.

it successfully when it has invaded the system. Those who have been short of proteid, pinched in food or half starved, are particularly liable to be attacked by tuberculosis, and those who have contracted the disease find their best prospect of arresting its progress in a regimen in which proteid food figures largely. The old treatment of tuberculosis, of which a spare diet formed a part, was disastrous in its consequences; the modern treatment, including a systematic administration of a diet of high nutritive value, is giving very encouraging results. So marked were the benefits accruing from this treatment when first introduced, that copious feeding was sometimes carried too far, the diets in some sanatoria reaching a proteid value of 200 grammes per diem and a total caloric value of 4000 or more. On these very large diets satisfactory progress was generally made, weight being gained in nearly every case, often to a large amount, but at the same time it was noticed that there was sometimes loss of appetite and that digestive and intestinal derangement followed, and so now a happy medium

Treatment Past and Present.

Sanatoria Fare.

has been established between the gargantuan fare of the early sanatoria and the customary subsistence allowance of the country. Dr. Noel Bardswell and Mr. John Chapman have, after a series of careful observations communicated to the Royal Society, arranged a diet which they have experimentally proved to be thoroughly satisfactory for the treatment of tuberculosis with a daily value of proteid of 154 grammes and 3889 calories. The whole of the proteid may, they say, be of vegetable origin, and that is of course desirable where strict economy is aimed at, but meat-free diets are not, they find, altogether convenient, inasmuch as they require very expert cooking to make them appetizing, and are never quite acceptable to persons who have been accustomed to eat meat. But whatever its source, it is the amount of proteid required that is the important point, and that, it will be noted, is two and a half times as much as Chittenden considers sufficient for an average man in health. But Chittenden's average man in health weighs 70 kilogrammes, or 154 lbs., whereas the average of the tubercular patients tested by Dr.

Meat-free Diets.

Bardswell and Mr. Chapman were, when put upon their diet, much beneath that weight. Only three reached or exceeded it, a large majority falling very far short of it, and being between 40 and 50 and 50 and 60 kilogrammes, so that, in proportion to body-weight, their proteid consumption was still more strikingly in excess of Chittenden's standard. No experienced medical man would venture to treat a case of phthisis on Chittenden's proteid quantum. Tubercular Patients.

And in other morbid conditions, besides tuberculosis — in hysteria, neurasthenia, and nervous disorders of many kinds—a liberal proteid intake—or rather input, for the diet is enforced—is serviceable. The remarkable results obtained in such conditions by what is known as the Weir-Mitchell treatment are now universally recognized, and that treatment consists in isolation, rest, massage, and electricity, plus high feeding in which the proteid element is conspicuous. And the high feeding in such conditions is sometimes prodigious. Dr. Ross, of Ventnor, has kindly weighed the average helpings of patients on full diet in the Hygeia The Weir-Mitchell Treatment.

Sanatorium there, which work out at proteid 510·3 grammes, fat 255·15, carbohydrates 7654—giving a total energy value of 28,908 large calories.

Fluids.

That is solid food, and in addition to that there is administered 1 pint of soup, giving proteid 42 grammes, carbohydrates 10, and fat 4; and 5 pints of milk, giving proteid 99·225, carbohydrates 136·08, and fat 113·4. The large amount of fluid insisted on is to ensure that the effete products are washed out, so that a daily renal secretion of from 80 to 100 ounces, with a specific gravity of something below 1015, is maintained.

Proteid Stoking.

Now, from Chittenden's point of view this heavy proteid stoking day after day should produce an amount of solid ash which the liver and kidneys cannot rake out, and which must slowly accumulate and smother the fire. We should have gastro-intestinal disturbances, bilious attacks, gout, rheumatism, toxæmia, and many other ailments; but as a matter of fact we have none of these things, but only improved nutrition and restored health. The lean and the flabby alike benefit by it, and no serious drawbacks are

encountered during its continuance. Dr. Ross found that in the last 100 cases under his care at Ventnor, with slight individual variations on the full 651 grammes proteid diet, the total gain in weight in 4654 days was 2054 lbs.—an average gain of 20·54 lbs. in an average stay of 46·54 days. The great flush of proteid was not only harmless but immediately beneficial, and permanently so in most cases. Weir-Mitchell patients gradually, sometimes suddenly, revert to their ordinary dietetic habits, but many of them long continue to take in the form of milk, meat, fish, and eggs, an amount of proteid which on any standard must be regarded as gigantic.

Dr. Ross's Cases.

I believe it to be a fact that a considerable proportion of the men who have to resort to the Weir-Mitchell treatment in a wasted and broken-down condition after middle life, confess that they have in former years played pranks with their nutrition, and have greatly reduced their diet in one way or another, under faddistic inspirations. They manifest the late or deferred effects of an unwise economy in nutrition.

Faddistic Inspirations.

Banting-Ebstein Obesity Systems.

In the treatment of obesity and the ailments associated with it, the most successful systems, those of Banting and Ebstein, for instance, are chemically characterized by the marked predominance of proteid in the diet adopted, a predominance which, according to the Chittenden school, must involve a dangerous excess of nitrogenous waste products, with strain on the liver and kidneys and injurious effects on the central and peripheral nervous system. But, as a matter of fact, one of these untoward consequences have been experienced by the sufferers from obesity who have tried such systems, and who were not suffering from disease of the kidneys, and have not carried them to a foolish extreme. They have almost invariably, while losing weight at a moderate rate, improved in general health, appetite and comfort, and the danger of all such systems lies not in the excess of nitrogen, but in the shortage of carbohydrates and fats, with perhaps 1000 calories below what is requisite to meet the disbursements of the body, and Chittenden, be it remembered, would materially reduce carbohydrates as well as proteid.

Healthy Losses.

Chittenden's researches, whatever the ultimate judgment on them may be, have had some useful effects. They have awakened widespread interest, have stimulated inquiry, and have no doubt led some indiscreet persons to moderate their indulgence in the pleasures of the table. It cannot be denied that there are classes, large classes, both in Europe and America, who habitually take more food, and especially more proteid food, than is necessary, advisable, or even safe. Luxury runs to proteid food, meat figures too largely and too often in the meals of well-to-do people, and as for the pampered domestics in big houses, who, it is alleged, eat meat largely three or four times a day, it can only be said that they are laying up wrath against the day of wrath. There is room for economy in nutrition, in certain directions, but much remains to be said before any wholesale and universal retrenchment in the outlay on food can be recommended. It seems to me that it is not so much economy as poverty in nutrition that is the pressing question of the hour. The Right Hon. Charles Booth found that in London 30·7

Useful Effects.

Economy.

per cent. of the population are in poverty, and therefore more or less under-nourished, and occasionally on the verge of starvation, and Mr. Rowntree found that the proportion of the poverty-stricken and distressed by hunger in York is about the same. Mr. Rowntree believes that the lethargy of the working man is due to his being chronically under-fed, and it is to be borne in mind that when the working man is pinched for food his wife and children go shorter than he. It would thus seem that nearly one-third of our urban population is under a compulsory economization of food, the consequence of which is not increased vigour, improved health, and exhilaration of spirits, but weakness, misery, and degeneration. "It is perfectly distressing to me," says Dr. Galton, "to witness the draggled, drudged, mean look of the women one meets in the streets of London and other purely English towns. The condition of their lives seems to be too hard for them and to be crushing them into degeneracy." And the condition of the children is still harder and more ominous of evil.

Under-feeding.

Degeneracy.

Investigations of a searching and

impartial character have now taken place into the condition of the elementary school children in a number of large towns, and they one and all reveal a deplorable degree of physical deterioration. To say nothing of diseases and defects mental and bodily, they afford striking evidence of the blighting influence of parcimony in nutrition while growth is going on. To cite one instance from Dundee, it was found there that the boys in a school from a poverty-stricken district were at 13 years of age, on the average, 2 ins. shorter and 6 lbs. lighter than the boys in another school recruited from a comfortable working-class and middle-class district, while the girls at the same age were in the poor school, on the average, 3 ins. shorter and 13 lbs. lighter than the girls in the better-class school. In York Mr. Rowntree found that at 13 years of age, the boys belonging to the well-fed class were upon an average 11 lbs. heavier and $3\frac{1}{2}$ ins. taller than those belonging to the poor and pinched section of the community. And this means not only a temporary set-back, but permanent damage, for feeding at the growth period

Physical Deterioration.

Boys in York.

determines all subsequent development.

Dwarfing.

Dwarfing, permanent dwarfing, of one kind or another, is the consequence of insufficient feeding in early life. Farmers know how difficult it is to remove the adverse influence of an inauspicious seeding season. Gardeners tell us that shoots that have been neglected or starved as shoots will never by any subsequent treatment make vigorous plants, and had better be cast aside. We see in our houses in autumn two kinds of flies, one large and the other small, so different in size that we unhesitatingly classify them as distinct species. Not at all. The small flies are simply dwarfs, because of scantiness of food during their larval stage. The investigators at the Lowestoft Marine Biological Laboratory found that small plaice transplanted from coastal waters where food is scanty to the Dogger Bank where it is abundant, grow very much more rapidly in their new than in their original habitat. By transplantation the rate of annual growth in length was increased from 2 ins. to 5 ins. in a year, or considerably more than doubled, the increase in weight being from $2\frac{1}{2}$ to 4 ozs.

Transplantation.

in home waters, and from $4\frac{1}{2}$ to 15 ozs. on the Dogger. So if we want to grow well-developed men and women, we must feed them not scantily but liberally in the days of their youth. Childhood is the larval stage in human beings. Economy in nutrition, according to Chittenden, would, I believe, be practised with the gravest risks in children, adolescents, and pregnant women. And it is to be hoped that the medical inspection of school children now happily instituted in this country will lead to the diffusion of sound knowledge as to what children should eat, drink, and avoid. The dietary in all our public schools and in most of our private ones, is now, no doubt, ample in amount, but in many instances in need of readjustment as to its constituent parts, but in some private schools the old meagre notions still prevail. A lady who is now a confirmed invalid assured me lately that her debility dates from partial starvation in a fashionable boarding school in a capital city, kept by a lady of high standing, bearing an honoured name, and a writer of authority on educational subjects. "There were

Childhood.

Boarding Schools.

fifteen of us boarders," she said; "we paid £150 a year, and we never had enough to eat. We rose at 7 a.m. and had breakfast at 8.30, consisting of weak tea, a thick bit of bread with a thin smear of butter. Butterine was substituted for butter until complaints were made, and then we had salt butter. Once a month a boiled egg was given at breakfast. Dinner, which came at one o'clock, consisted of two courses, soup and meat, or meat and pudding, vegetables being always served with the meat. But the meat was always doled out in very small portions, and although second helpings were nominally allowed, they were regarded with disapprobation, and were scarcely worth asking for. Sausage was sometimes supplied in place of meat, and then each girl had a single sausage. Tea at six o'clock consisted of weak tea and bread-and-butter as at breakfast, but occasionally jam of a livid complexion was substituted for butter. We were always hungry, and all our pocket-money went on food. I was growing fast, and often felt faint and ill, but it would not do to complain, for a girl on the sick list was

Fashionable Starvation.

Faint and Ill.

isolated and fed on gruel or arrowroot made with water."

Food Selection and Preparation.

The poor have much to learn in the way of economy in food, but it is economy in the selection and preparation of food, and not in the lopping off of proteid. The urgent question for us to-day is not how we may teach them to thrive on an attenuated fare, but "whence shall we buy bread that these may eat?" We should aim not at parcimony in nutrition, but try to "scatter plenty o'er a smiling land."

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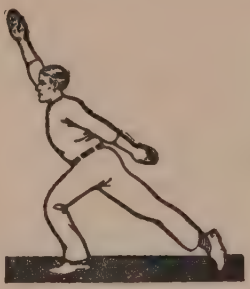

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